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G. O. FROSTAD ET AL

2,283,003

PRINTING APPARATUS

Filed May 13, 1940

3 Sheets-Sheet 1

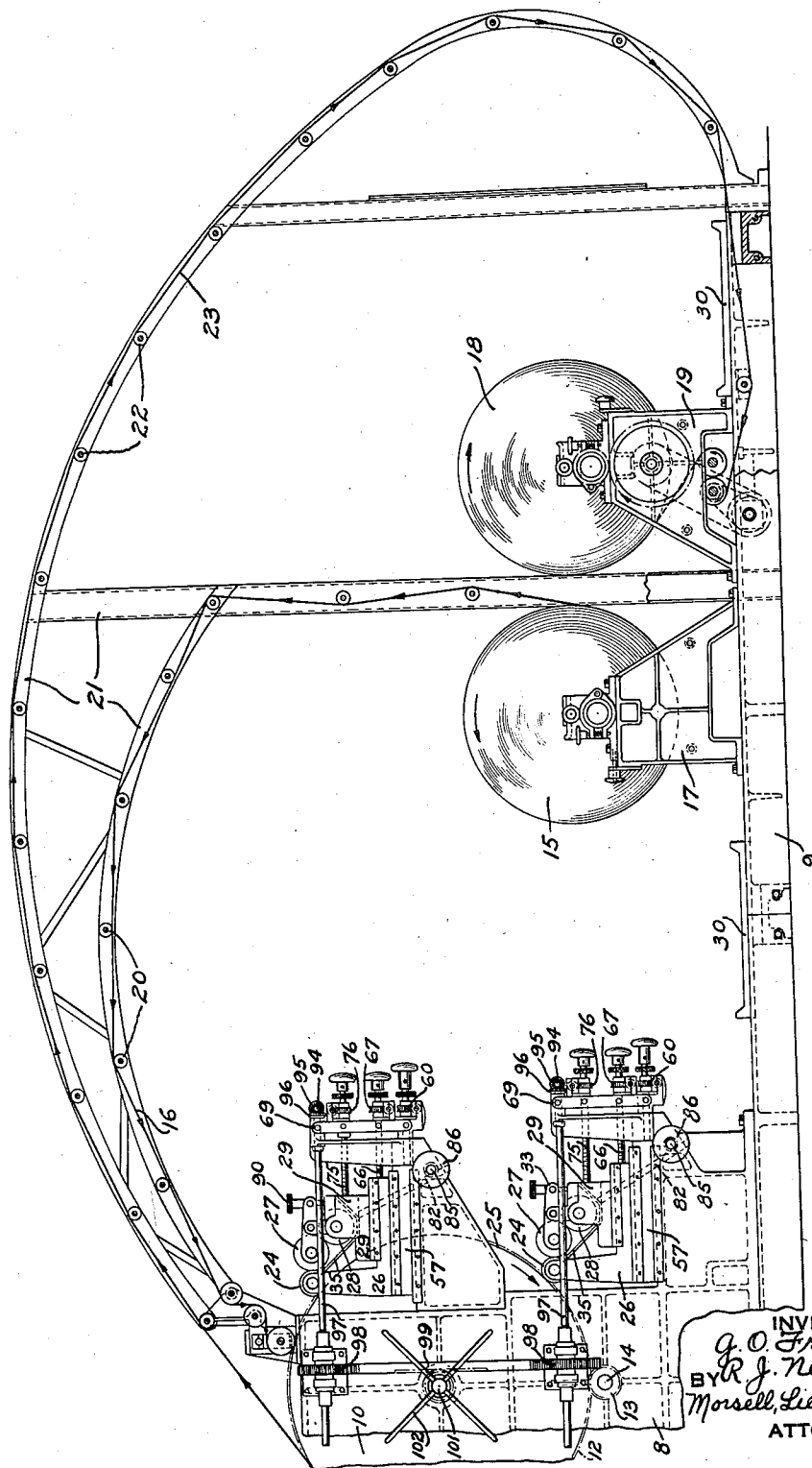


Fig. 1.

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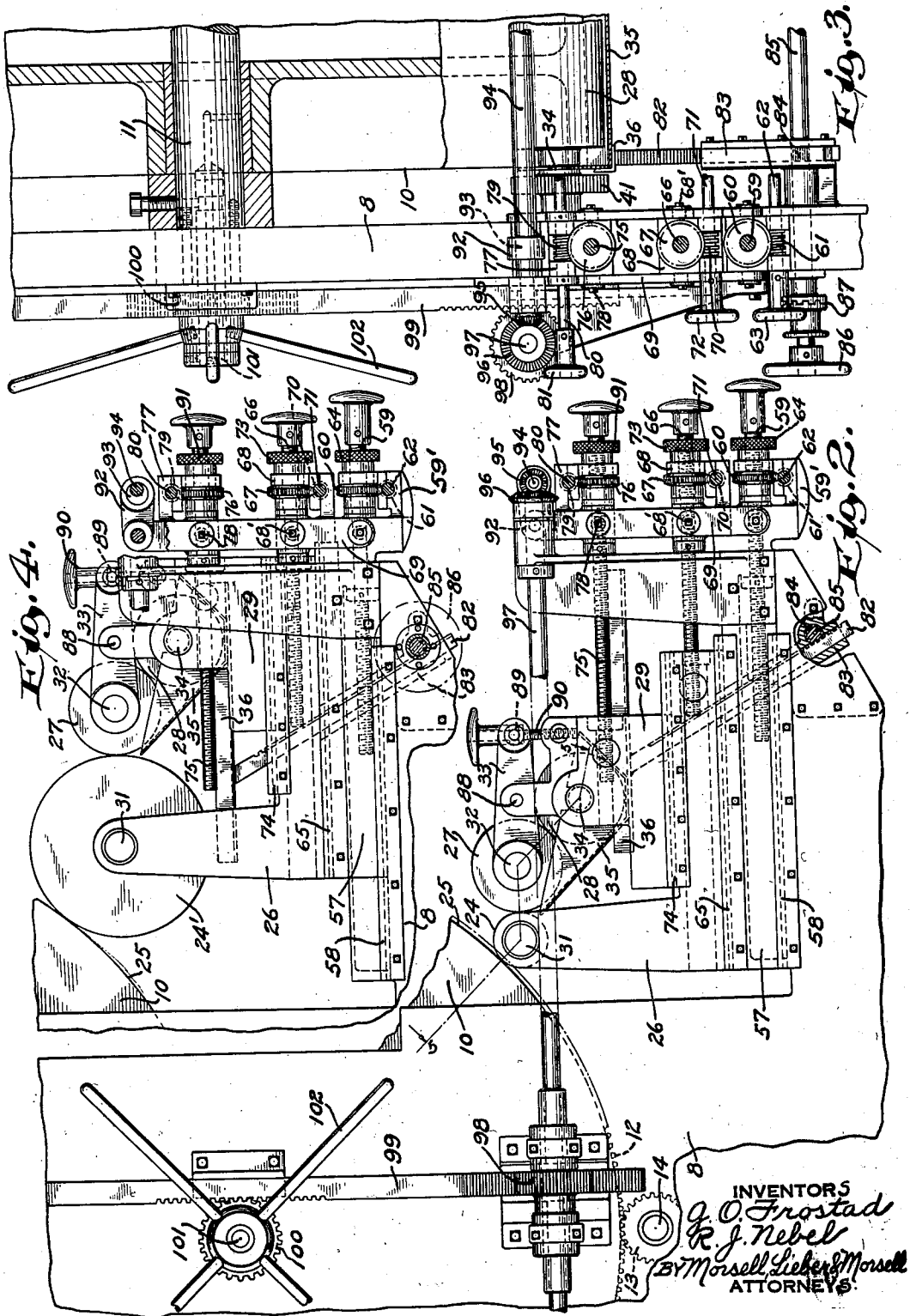
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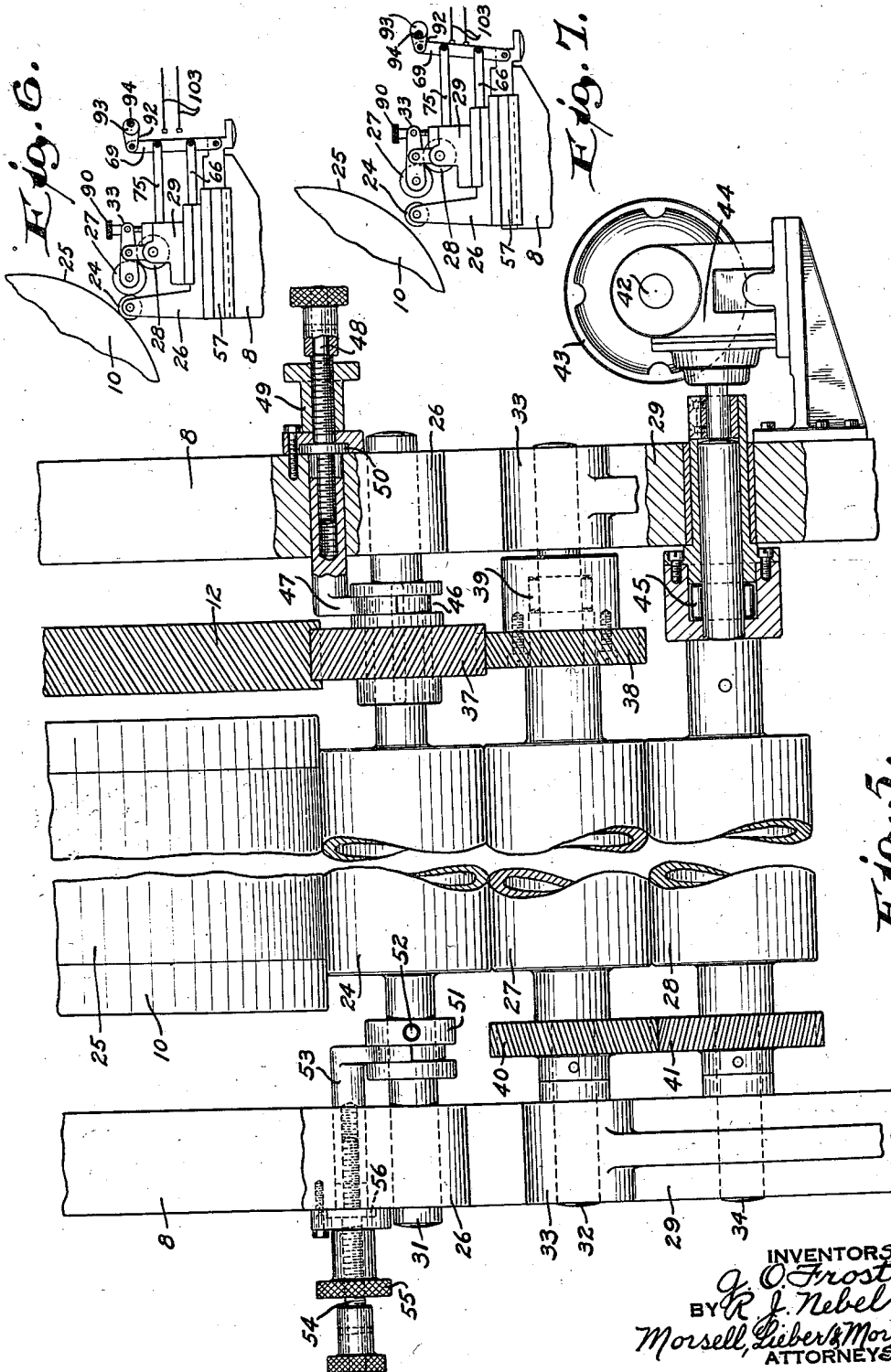
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UNITED STATES PATENT OFFICE

2,283,003

PRINTING APPARATUS

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28 Claims. (Cl. 101—182)

Our invention relates in general to improvements in the art of printing, and relates more specifically to improvements in the construction and operation of printing apparatus or presses of the rotary cylinder type.

A primary object of the present invention is to provide improved printing apparatus which is relatively simple, compact and durable in construction, and which is moreover highly efficient and flexible in operation.

When printing sheets or webs of relatively delicate materials such as regenerated cellulose, wax or glassine paper, metal foils, cloth, fancy paper, or the like, with special inks, in a variety of colors, and at high speed, many difficulties are encountered. Because of the fact that many of the special inks used for this class of work, tend to dry rapidly, it is necessary to avoid stoppage of the ink transfer rollers in order to prevent the ink from drying thereon, when the rotation of the plate or type cylinders is temporarily arrested to permit inspection, cleaning or adjustments of parts. It is also frequently desirable to stop the rotation of the impression cylinder and of the type cylinders for inspection or cleaning thereof, and in such cases it should be possible to again re-start the machine and to bring the impression and plate cylinders into proper coaction gently and without shock. When performing multi-color work, it is also desirable that the operator be able to conveniently and accurately adjust the various parts for most effective and true registration; and while machines of this general class should be operable at variable speeds and at relatively high maximum speed, they should also be adapted for quick and safe stoppage. It should also be possible to quickly vary the diameters of the plate or type cylinders of these rotary printing machines, and to readily aline the cooperating type and impression cylinders and the ink transfer rollers; and it is also desirable to provide means for effecting proper positioning and adjustment of the ink supply pan, with minimum effort.

It is therefore a more specific object of our present invention to provide an improved printing press which effectively meets all of the above-mentioned requirements and desirable modes of operation, in a simple and highly efficient manner.

Another specific object of this invention is to provide improved throw out mechanism for simultaneously removing a plate or type cylinder from an impression cylinder and the sheet or web coacting with the latter, and the ink

supply roll from the plate or type cylinder, and for maintaining the ink transfer rolls in operation even if the rotation of either of said cylinders is arrested.

A further specific object of the invention is to provide improved mechanisms for quickly and accurately effecting adjustment of various parts of a cylinder press in a manner which will insure true registration of multi-colors and most efficient cooperation of the various elements of the assemblage.

Still another specific object of our invention is to provide an improved printing device capable of making impressions in various colors in rapid succession on a continuous relatively frail web travelling at high speed, without danger of tearing or marring the web.

An additional specific object of the present invention is to provide various improvements in the details of construction and operation of cylinder printing presses, whereby the efficiency and safety thereof is enhanced to a maximum, while the cost of production of the printed matter is minimized.

These and other objects and advantages of our invention will be apparent from the following detailed description.

A clear conception of the several features constituting our present improvement, and of the mode of constructing and of operating printing presses built in accordance with the invention, may be had by referring to the drawings accompanying and forming a part of the specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a somewhat diagrammatic and part sectional side elevation of one of our improved printing press assemblages showing two sets of type cylinders and ink transfer rolls cooperating with a common impression cylinder;

Fig. 2 is an enlarged fragmentary side view of the impression cylinder and of one of the type cylinder and ink transfer assemblages, showing a type or plate cylinder of minimum diameter;

Fig. 3 is a similarly enlarged fragmentary and part sectional end view of the mechanism shown in Fig. 2;

Fig. 4 is a likewise enlarged side view similar to that of Fig. 2, but showing a type or plate cylinder of maximum diameter;

Fig. 5 is a further enlarged irregular development of fragments of the impression and type cylinders and of the ink transfer rolls, showing the ink roll drive and type cylinder adjusting

mechanism, the development following the line 5—5 of Fig. 2;

Fig. 6 is a diagram of the type cylinder and ink roll throw out mechanism, showing the elements in active position; and

Fig. 7 is a similar diagram showing the element in inactive position, with the ink transfer rolls being rotated by the auxiliary propelling means.

While our invention has been shown and described in connection with a continuous web revolving cylinder press having a plurality of plate or type cylinder assemblages cooperable with a common impression cylinder, it is not our desire or intention to thereby unnecessarily restrict the scope or utility of the improvement.

Referring to the drawings, and especially to Figs. 1, 2 and 3, the improved printing apparatus shown therein comprises in general a main frame 8 of sturdy construction mounted upon an equally sturdy elongated base 9; a relatively large impression cylinder 10 journaled for rotation upon a hollow horizontal shaft 11 secured to the frame 8, the cylinder 10 having peripheral teeth 12 meshing with a driving pinion 13 carried by a power shaft 14 which is journaled in bearings also mounted on the frame 8; a web supply roll 15 journaled for frictional rotation by pull on the supply web 16, upon a sub-frame 17 carried by the base 9 some distance from the frame 8; a printed web receiving roll 18 journaled for positive rotation by suitable driving mechanism, upon another sub-frame 19 carried by the base 9 remote from the frame 8; a series of tensioning and guiding rollers 20 supported by overhead framing 21, and coacting with the supply web 16 passing from the roll 15 to the cylinder 10; another series of tensioning and guiding rollers 22 supported by the overhead framing 21 and coacting with the printed web 23 delivered from the impression cylinder 10 to the receiving roll 18; one or more form, plate or type cylinders 24, each adapted to coact with the web portion 25 embracing the impression cylinder 10, and being journaled for rotation in a lower carriage 26 which is movable along coacting slides 57 resting upon the frame 8, toward and away from the cylinder 10; an ink doctor or transfer roll 27 adapted to coact with each type cylinder 24, and to also constantly engage an adjacent ink feed roll 28, the rolls 27, 28 being journaled for rotation in an upper carriage 29 slidably supported upon the lower carriage 26; and mechanism for simultaneously shifting the carriages 26, 29 relative to the impression cylinder 10 and relative to each other so as to make the type cylinders 24 either active or inactive at will.

Each of the frames 8, 17, 19 may consist of spaced side elements rigidly attached to the base 9, and the latter may be formed of a series of firmly united sections and may be provided with transverse walks 30 for the attendant, see Fig. 1. The power shaft 14 and the mechanism for positively revolving the roll 18 may be driven in synchronism by means of one or more motors, not shown, and the rotation of the web supply roll 15 should be retarded sufficiently to prevent free whirling thereof. Each of the type cylinders 24 is rotatably supported by a shaft 31 journaled in the lower carriage 26, and the ink transfer roll 27 of each set is rotatable about a shaft 32 which is journaled for rotation in levers 33 pivotally suspended from the upper carriage 29. The ink pan roll 28 of each set is rotatable about a shaft 34 which is journaled for rotation

in the upper carriage 29, and the roll 28 has its lower peripheral portion disposed within an ink pan 35 slidably supported upon a vertically adjustable shelf 36. The peripheral driving teeth 12 of the impression cylinder 10, are preferably of the helical type as shown in Fig. 5, and are adapted to mesh with a helical gear 37 secured to an end of the type cylinder 24 and keyed to the shaft 31, so that when the cylinder 24 is in active position and the cylinder 10 is rotating, the cylinder 24 will also rotate in contact with the web portion 25. The gear 37 is adapted to mesh with a helical gear 38 secured to an end of the ink transfer or doctor roll 27, and this gear 38 is connectable to the adjacent portion of the supporting shaft 32 by means of a free wheeling or one-way clutch 39 which is effective to drive the shaft 32 only when the roll 27 coacts with the type cylinder 24. The end of the shaft 32 remote from the clutch 39, has a gear 40 secured thereto, which constantly meshes with a gear 41 secured to the ink pan roll supporting shaft 34, and the end of the shaft 34 remote from the gear 41 is connectable to the shaft 42 of an auxiliary motor 43, through reduction gearing 44 and by means of another free wheeling or one-way clutch 45 which is effective only when the ink transfer roll 27 is disengaged from the type cylinder 24. The assemblage is such, that when the press is operating normally, the rotation of the impression cylinder 10 by the power shaft 14 and gear 13, will impart positive rotary motion to the cylinder 24 and ink rolls 27, 28 through the teeth 12, gears 37, 38, clutch 39, and gears 40, 41; whereas when the cylinders 10, 24 are inactive, the ink rolls 27, 28 will be rotated by the motor 43 through the shaft 42, reduction gearing 44, clutch 45, shaft 34, and gears 40, 41.

In order to insure positive registry of all of the type cylinders 24, with the work or sheet portion 25 carried by the impression cylinder 10, it is necessary to provide some means for effecting both rotary as well as longitudinal adjustment of the cylinders 24 relative to the cylinder 10. While the improved mechanism for effecting such adjustment of each plate or type cylinder 24 has been omitted from the smaller disclosures, it is shown in detail in Fig. 5. The helical gear 37 is provided with a central sleeve which is splined for sliding along the shaft 31, and has an annular end groove 46 therein, with which an adjusting fork 47 coacts, and this fork 47 is slidable in a hole in the side wall of the lower carriage 26 by means of an adjusting screw 48 having a lock nut 49 and a fixed collar 50 thereon. The portion of the shaft 31 remote from the gear 37 has a grooved collar 51 thereon and adapted to be secured thereto by one or more set screws 52, and another fork 53 which is slidable in the opposite side wall of the carriage 26 coacts with the groove in the collar 51. The fork 53 is movable by means of an adjusting screw 54 having a lock nut 55 and a fixed collar 56 thereon, and the screw 54, fork 53, collar 51 and set screws 52 normally serve to prevent longitudinal or axial shifting of the shaft 31 and type cylinder 24. When the lock nut 49 is released, the screw 48 may be manipulated to shift the fork 47 and helical gear 37 along the shaft 31, thereby rotating the type cylinder 24 relative to the impression cylinder 10, without producing relative longitudinal shifting of these cylinders. In order to obtain relative longitudinal adjustment of the cylinders 10, 24, it is only necessary to loosen the lock nut 55 and to manipulate

the adjusting screw 54, thereby causing the fork 53 to pull or push the shaft 31 and cylinder 24 without moving the gear 37. Proper rotary and longitudinal registry may therefore be independently effected at each type cylinder 24, by manipulating the proper adjusting screws 48, 54; and it is to be noted that the inclination of the teeth of the helical gears 12, 37 is useful in effecting rotary adjustment of the several cylinders 24 about their axes. These adjustments for registry may also be made either while the press is stopped or in operation.

It frequently becomes desirable to change the type or plate set up, and to replace the small type cylinders 24 with a larger cylinder 24', see Figs. 2 and 4, and in order to permit this to be done, each slidable lower carriage is mounted upon spaced slides 57 which are adjustable along guides 58 and relative to the main frame 8, by means of a pair of horizontal lowermost threaded spindles or adjusting screws 59. The adjusting screws 59 of each set, are journaled for rotation in brackets 59' carried by the slides 57 and have screw thread coaction with the fixed frame 8, so that simultaneous rotation of the two screws 59 will cause the slides 57 to travel equal distances along their fixed supporting guides 58. Relative adjustment between the two slides 57 of each set, may be obtained by manipulating one screw 59 to the exclusion of the other, and in order to facilitate simultaneous rotation of the two screws 59 of a set, each screw may be provided with a worm wheel 60 coacting with the threads thereof, and these worm wheels 60 may be caused to coact with spaced screw threads or worms 61 carried by a transverse shaft or rod 62 having a hand wheel 63 thereon, so that by turning the hand wheel 63 the worm wheels 60 will be rotated together and will move the two screws 59 equal amounts in the same direction. The screws 59 may be locked in adjusted position by means of a nut 64, and the worm wheels 60 are prevented from shifting axially by virtue of their coaction with the brackets 59'. When the slides 57 are thus shifted toward and away from the impression cylinder 10 to accommodate type cylinders 24, 24' of different diameters, the lower carriages 26 and the upper carriage 29 will be correspondingly moved, as a unit; and after the slides 57 have been moved the required distance to properly position the lower carriage 26, the upper carriage 29 should be adjusted to properly position the inking rolls 27, 35 so as to provide sufficient clearance for insertion of the new type cylinder 24'.

In order to effect shifting of the lower carriage 26 and cylinder 24 either simultaneously with or relative to its supporting slides 57, intermediate threaded spindles or adjusting screws 66 coacting with the opposite sides of the carriage 26 and with worm wheels 67, are provided. The worm wheels 67 are journaled for rotation in brackets 68 which are pivotally suspended by pivots 68' from the medial portions of levers 69 having their lower ends pivotally suspended from the lower brackets 59', and the worm wheels 67 coact with spaced screw threads or worms 70 secured to a transverse shaft or rod 71 journaled in the pivot brackets 68 and having a hand wheel 72 thereon, so that rotation of the hand wheel 72 will cause the worm wheels 67 to rotate in unison to thereby move both screws 66 to shift the carriage 26. The screws 66 are also provided with lock nuts 73 for positively preventing rotation of the screws 75

66 and worm wheels 67, and for maintaining the parts in adjusted position.

In order to effect shifting of the upper carriage 29 and rolls 27, 28 relative to the lower carriage 26, the carriage 29 is caused to coact with guides 74 on the carriage 26, and upper threaded spindles or adjusting screws 75 coacting with the opposite sides of the carriage 29 and with worm wheels 76, are provided. These worm wheels 76 are journaled for rotation in brackets 77 which are pivotally suspended by pivots 78 from upper portions of the levers 69, and the worm wheels 76 coact with spaced screw threads or worms 79 secured to another transverse shaft or rod 80 journaled in the brackets 77 and provided with a hand wheel 81, so that rotation of the hand wheel 81 will cause the worm wheels 76 to rotate simultaneously and thereby move both screws 75 to shift the carriage 29. During such back and forth movement of the carriage 29, the ink pan 35 into which the lower roll 28 extends, will be slid along the shelf rails 36, and these rails are provided with downwardly extending inclined racks 82 which coact with guideways 83 on the frame 8. The racks 82 are movable along the guideways 83 by means of pinions 84 carried by a transverse shaft 85 and coacting with the rack teeth, and the shaft 85 is rotatable with the aid of a hand wheel 86 and is normally locked against rotation by a jaw clutch 87. By releasing the clutch 87 and turning the shaft 85 with the aid of the hand wheel 86, the shelf 36 and the ink pan 35 may be raised or lowered as desired. In order to bring the ink transfer roll 27 which is suspended from the levers 33, into proper coaction with the roll 28 and cylinder 24, the suspension levers 33 are swingably suspended at their medial portions from pivot pins 88 carried by the carriage 29, and the ends of the levers 33 remote from the roll 27 are provided with pivot blocks 89 in which adjusting screws 90 are journaled. The threaded lower ends of the screws 90 coact with the carriage 29 in such manner that turning of the screws 90 will cause the levers 33 to swing about the pins 88 and will thereby raise or lower the doctor roll 27. The rolls 27, 28 may therefore be adjusted relative to each other, and may be simultaneously moved toward or away from the type cylinder 24 with the aid of the screws 75, and these screws are adapted to be locked in adjusted position by means of lock nuts 91.

It frequently becomes desirable in the operation of printing presses of this kind, to remove the plate or type cylinders 24, 24' from the impression cylinder 10 and web portion 25, and to simultaneously remove the ink transfer roll 27 from the type cylinder, either in order to effect adjustment of parts or to remove the type cylinder for replacement. This separation of the elements when desired for any reason, may be effected with the aid of the levers 69 coacting with the blocks or pivot brackets 77, 68 and with the carriages 29, 26 respectively, through the screws 75, 66, see Figs. 2, 3, 4, 6 and 7. The upper ends of the levers 69 are pivotally connected to the corresponding ends of links 92, the opposite ends of which coact with eccentrics 93 secured to a transverse shaft 94 which is journaled in the slide 57. The shaft 94 is rotatable to simultaneously revolve the eccentrics 93, by means of a bevel gear 95 which coacts with another bevel gear 96 secured to one end of another shaft 97 having a spur gear 98 thereon. The gear 98 coacts with a rack 99 slidably supported by the

frame, and the rack 99 is vertically reciprocable by means of a pinion 100 secured to a shaft 101 journaled in the frame 8 concentrically of the cylinder 10, and having hand levers 102 secured to an end thereof. The shaft 97, gear 98, rack 99 and pinion 100 may be duplicated on the opposite side of the machine, and the shaft 101 is in that case, extended through the hollow shaft 11 of the impression cylinder 10, so that the single set of levers 102 may be utilized to actuate both rack and pinion assemblages. The vertically slidable racks 99 are also adapted to cooperate with several of the shafts 97, and these shafts are moreover adapted to coact with the eccentrics 93 of a plurality of type cylinder and inking units, so that all of the type cylinders 24, 24' coacting with the impression cylinders will be thrown out and brought into action simultaneously. Since it is desirable to have the inking rolls 27, 28 continue to rotate at all times and even when the rotation of either or both cylinders 10, 24 is arrested, the auxiliary motor 43 has been provided for the purpose of rotating the rolls 27, 28 whenever the driving coaction between the gears 37, 38 is interrupted. One of the levers 69 may be caused to make contact in the electrical feed line 103 of the auxiliary motor circuit, when the levers 69 are swung away from the cylinder 10 as in Fig. 7, so that the motor 43 will immediately become effective to rotate the inking rolls 27, 28 whenever the normal drive for these rolls is interrupted.

While the normal operation of the improved printing press should be relatively apparent from the foregoing detailed description, this operation may be described generally as follows. After the impression cylinder 10, the type cylinder 24, and the inking rolls 27, 28, have been brought into proper cooperative relation, the web may be fed from the supply roll 15 around the impression cylinder 10 and back to the discharge roller 18, and as the impression cylinder 10 is revolved by application of driving power to the shaft 14, the web will continuously travel from the roller 15 around the cylinder 10 and to the roller 18. During this advancement of the web, which may be at relatively high speed, the type cylinders 24 which are constantly supplied with ink from the pans 35 by the rolls 28, 27, will print upon the web portion 25 as this web portion is conveyed past the type cylinders. If it becomes desirable to remove the type cylinders 24 from coaction with the web portion 25, this may be done at any time by merely manipulating the radial levers 102. As the shaft 101 is rotated to cause the rack 99 to move, the shafts 97 will also be rotated thereby causing the eccentrics 93 which are carried by the shafts 94 to rotate. The levers 69 will then be shifted from the position shown in Fig. 6, to that shown in Fig. 7, thereby removing the type cylinders 24 from the impression cylinder 10, and simultaneously removing the doctor rolls 27 from the type cylinders 24. This separation of the ink transfer rolls 27 from the type cylinders 24, will also remove the ink roll driving gears 38 from the gears 37, and simultaneously with this removal the levers 69 will complete the electrical circuit in the line 103, thereby placing the auxiliary motors 43 in operation. These motors 43 will then become effective to continue the rotation of the ink rolls 27, 28, and will thus prevent the ink from drying on these rolls. The operation of the throw out mechanism will then permit safe access to the plate or type rolls 24,

for adjustment or cleaning, and adjustment of each of these rolls 24 may then be effected, independently of all of the others, by manipulating the adjusting screws 48, 54 shown in Fig. 1, in a manner previously described.

If for any reason it should become desirable to replace the type cylinders 24 by other cylinders 24' of different diameter, the slide 57 may be withdrawn from the impression cylinder 10, and the carriage 29 may be slid along the carriage 26 in a direction away from the impression cylinder 10, by merely manipulating the screws 59, 66, 75. During this sliding of the carriage 29 relative to the carriage 26, the ink pan 35 will be slid along the shelf rails 36. The location of the type cylinders 24, and of the ink rolls 27, 28 may be independently adjusted by manipulating the proper adjusting screws 59, 66, 75, and these screws may be locked in adjusted position. The location of the doctor roll 27 relative to the ink pan roll 28 and relative to the type cylinder 24, may be adjusted by manipulating the adjusting screw 90, and the worm gearing interposed between each of the adjusting screws 59, 66, 75 on opposite sides of the machine, will permit convenient and simultaneous adjustment of the elements on the opposite sides of the machine, which cooperate with the several adjusting screws. The ink pan 35 may be raised or lowered by manipulating the hand wheel 86, after the clutch 87 has been released, thus providing various adjustments which materially enhance the flexibility of operation of the machine.

From the foregoing detailed description it will be apparent that our present invention provides a relatively simple, compact and durable rotary printing press, which is highly efficient in operation and extremely flexible in use. The press may be operated to produce printing having a variety of colors, or only a single color, and the single set of hand levers 102 serve to actuate the throw outs on all of the type cylinder units. All portions of the machine are conveniently accessible for inspection and adjustment, and those portions which are subject to considerable vibration during normal use of the machine, are adapted to be locked in adjusted position. The throw out of the type cylinders and ink rolls may be quickly effected, and the ink is prevented from drying on the ink transfer rolls whenever such throw out of the type cylinder takes place. The functioning of the machine in this respect is automatic except that the throw out mechanism is actuated manually, and by virtue of the fact that the impression cylinder 10 is rotatable about a hollow shaft, the throw out motion transfer mechanism may be readily duplicated on opposite sides of the printing press.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of use, herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

We claim:

1. Printing apparatus comprising, an impression cylinder rotatable about an axis, lower and upper carriages movable parallel to each other toward and away from the periphery of said cylinder, a plate cylinder journaled upon said lower carriage and normally coacting with said impression cylinder, an ink roll carried by said upper carriage and normally coacting with said plate cylinder, and means for simultaneously

moving said carriages relative to said impression cylinder and relative to each other to separate said cylinders from each other and said plate cylinder from said roll.

2. Printing apparatus comprising, an impression cylinder rotatable about an axis, lower and upper carriages movable parallel to each other toward and away from the periphery of said cylinder, a plate cylinder journaled upon said lower carriage and normally coacting with said impression cylinder, an ink roll carried by said upper carriage and normally coacting with said plate cylinder, and a lever pivotally associated with said carriages for simultaneously moving the same relative to each other and relative to said impression cylinder to separate said cylinders from each other and from said roll.

3. Printing apparatus comprising, an impression cylinder rotatable about an axis, lower and upper carriages movable parallel to each other toward and away from the periphery of said cylinder, a plate cylinder journaled upon said lower carriage and normally coacting with said impression cylinder, an ink roll carried by said upper carriage and normally coacting with said plate cylinder, a lever pivotally associated with said carriages for simultaneously moving the same relative to each other and relative to said impression cylinder to separate said cylinders from each other and from said roll, and means for effecting independent adjustment of said carriages relative to said lever.

4. Printing apparatus comprising, an impression cylinder, a pair of carriages movable parallel to each other toward and away from the periphery of said cylinder, a plate cylinder suspended from one of said carriages and normally coacting with said impression cylinder, an ink roll suspended from the other of said carriages and normally coacting with said plate cylinder, and means for effecting either independent or simultaneous movement of said carriages toward or away from said impression cylinders.

5. Printing apparatus comprising, an impression cylinder rotatable about a fixed horizontal axis, a lower carriage slidable upon a fixed support toward and away from said cylinder, an intermediate carriage slidable upon said lower carriage, a plate cylinder journaled upon said intermediate carriage for rotation about a horizontal axis, an upper carriage slidable upon said intermediate carriage, an ink roll journaled upon said upper carriage for rotation about a horizontal axis, and means for effecting movement of said lower carriage to cause simultaneous movement of said plate cylinder and roll toward or away from said impression cylinder and for also effecting relative movement of all of said carriages to move said cylinders relative to each other and to said roll.

6. Printing apparatus comprising, an impression cylinder rotatable about a fixed horizontal axis, a lower carriage slidable upon a fixed support toward and away from said cylinder, an intermediate carriage slidable upon said lower carriage, a plate cylinder journaled upon said intermediate carriage for rotation about a horizontal axis, an upper carriage slidable upon said intermediate carriage, an ink roll journaled upon said upper carriage for rotation about a horizontal axis, and means for effecting either independent or simultaneous sliding of said carriages relative to each other.

7. Printing apparatus comprising, an impression cylinder rotatable about a fixed horizontal

axis, a lower carriage slidable upon a fixed support toward and away from said cylinder, an intermediate carriage slidable upon said lower carriage, a plate cylinder journaled upon said intermediate carriage for rotation about a horizontal axis, an upper carriage slidable upon said intermediate carriage, an ink roll journaled upon said upper carriage for rotation about a horizontal axis, and a lever pivotally associated with all of said carriages for effecting simultaneous movement of said upper and intermediate carriages relative to each other and at different rates of speed.

8. Printing apparatus comprising, an impression cylinder rotatable about a horizontal axis, a lower carriage slidable toward and away from said cylinder, an intermediate carriage slidable upon said lower carriage and providing a support for a rotary plate cylinder coacting with said impression cylinder, an upper carriage slidable upon said intermediate carriage and providing a support for a rotary ink roll coacting with said plate cylinder, a lever pivotally suspended from said lower carriage and being connected to said intermediate and upper carriages, and eccentric means for effecting swinging of said lever to simultaneously displace said plate cylinder and said roll relative to said impression cylinder and to each other.

9. Printing apparatus comprising, an impression cylinder rotatable about a horizontal axis, a lower carriage slidable toward and away from said cylinder, an intermediate carriage slidable upon said lower carriage and providing a support for a rotary plate cylinder coacting with said impression cylinder, an upper carriage slidable upon said intermediate carriage and providing a support for a rotary ink roll coacting with said plate cylinder, means for shifting said lower carriage to simultaneously shift said plate cylinder and roll relative to said impression cylinder, and means for shifting said intermediate carriage upon said lower carriage and said upper carriage upon said intermediate carriage to relatively displace said plate cylinder and said roll.

10. Printing apparatus comprising, an impression cylinder rotatable about a fixed horizontal axis, a lower support movable toward and away from said cylinder, a plate cylinder rotatable about a horizontal axis and being cooperable with said impression cylinder to effect printing, an intermediate support resting upon said lower support and upon which said plate cylinder is journaled, an ink roll rotatable about a horizontal axis and being cooperable with said plate cylinder to distribute ink thereon, an upper support resting upon said intermediate support and upon which said roll is journaled, and means for effecting relative movement of said supports to separate said cylinders and said roll.

11. Printing apparatus comprising, an impression cylinder rotatable about a fixed horizontal axis, a lower support movable toward and away from said cylinder, a plate cylinder rotatable about a horizontal axis and being cooperable with said impression cylinder to effect printing, an intermediate support resting upon said lower support and upon which said plate cylinder is journaled, an ink roll rotatable about a horizontal axis and being cooperable with said plate cylinder to distribute ink thereon, an upper support resting upon said intermediate support and upon which said roll is journaled, and a lever connecting said supports and being operable to simultaneously move said plate cylinder and roll

relative to said impression cylinder and to each other.

12. Printing apparatus comprising, an impression cylinder rotatable about a fixed horizontal axis, a lower support movable toward and away from said cylinder, a plate cylinder rotatable about a horizontal axis and being cooperable with said impression cylinder to effect printing, an intermediate support resting upon said lower support and upon which said plate cylinder is journaled, an ink roll rotatable about a horizontal axis and being cooperable with said plate cylinder to distribute ink thereon, an upper support resting upon said intermediate support and upon which said roll is journaled, a lever swingably suspended from said lower support and having upper swinging portions thereof connected to said intermediate and upper supports, and an eccentric operatively associated with the swinging end of said lever to simultaneously move said supports.

13. Printing apparatus comprising, an impression cylinder rotatable about a fixed horizontal axis, a lower support movable toward and away from said cylinder, a plate cylinder rotatable about a horizontal axis and being cooperable with said impression cylinder to effect printing, an intermediate support resting upon said lower support and upon which said plate cylinder is journaled, an ink roll rotatable about a horizontal axis and being cooperable with said plate cylinder to distribute ink thereon, an upper support resting upon said intermediate support and upon which said roll is journaled, a lever swingable to simultaneously move said supports, and means for effecting variation in the relative movement of said supports by said lever.

14. Printing apparatus comprising, an impression cylinder rotatable about a fixed horizontal axis, a lower support movable toward and away from said cylinder, a plate cylinder rotatable about a horizontal axis and being cooperable with said impression cylinder to effect printing, an intermediate support resting upon said lower support and upon which said plate cylinder is journaled, an ink roll rotatable about a horizontal axis and being cooperable with said plate cylinder to distribute ink thereon, an upper support resting upon said intermediate support and upon which said roll is journaled, a pair of laterally spaced simultaneously swingable levers interconnecting said supports, and means for swinging said levers in unison to produce parallel movement of said plate cylinder and roll relative to said impression cylinder and to each other.

15. Printing apparatus comprising, an impression cylinder rotatable about a fixed horizontal axis, a lower support movable toward and away from said cylinder, a plate cylinder rotatable about a horizontal axis and being cooperable with said impression cylinder to effect printing, an intermediate support resting upon said lower support and upon which said plate cylinder is journaled, an ink roll rotatable about a horizontal axis and being cooperable with said plate cylinder to distribute ink thereon, an upper support resting upon said intermediate support and upon which said roll is journaled, a pair of laterally spaced levers pivotally suspended from said lower support and being connected to the opposite side portions of said intermediate and upper supports, and eccentric means for simultaneously swinging said levers to produce parallel displacement of said plate cylinder and roll relative to said impression cylinder and to each other.

16. In combination, a form cylinder, an inking mechanism therefor comprising, an ink fountain, a fountain roller revoluble therein, means for adjusting the fountain and roller together toward and away from the form cylinder, said adjusting means comprising a pair of threaded spindles, worm wheels internally threaded thereon, a threaded shaft in operative engagement with said worm wheels, and means for turning said shaft.

17. In combination, an impression cylinder, a form cylinder, an inking mechanism therefor comprising, an ink fountain, a fountain roller revoluble therein, means for adjusting the form cylinder, ink fountain and fountain roller as a unit toward and away from the impression cylinder, means for adjusting the ink fountain toward and away from the form cylinder, said fountain adjusting means being operable independently of said form cylinder adjusting means.

18. In combination, an impression cylinder, a form cylinder, an inking mechanism therefor comprising, an ink fountain, a fountain roller revoluble therein, means for adjusting the form cylinder, ink fountain and fountain roller as a unit toward and away from the impression cylinder, said means including mechanism for further adjusting the form cylinder and inking mechanism as a unit at each end separately toward and away from the impression cylinder, and means for maintaining the peripheral relationship of the fountain roller and form cylinder during said adjustments.

19. In combination, a form cylinder, inking mechanism comprising an ink fountain and a fountain roller revoluble therein to deliver ink to said form cylinder, and means for simultaneously adjusting said fountain and roller toward and away from said form cylinder, said adjusting means including a pair of rotary spindles, worm wheels carried by said spindles, and a rotary shaft having screw threads in operative engagement with said worm wheels.

20. In combination, a form cylinder, inking mechanism comprising an ink fountain and a fountain roller revoluble therein to deliver ink to said form cylinder, and means for simultaneously adjusting said fountain and roller toward and away from said form cylinder, said adjusting means including a pair of rotary spindles, worm wheels carried by said spindles, a rotary shaft having screw threads in operative engagement with said worm wheels, and means for turning said shaft to simultaneously rotate said worms.

21. In combination, an impression cylinder, a form cylinder, inking mechanism comprising an ink fountain and a fountain roller revoluble therein to deliver ink to said form cylinder, means for adjusting the form cylinder and inking mechanism as a unit toward and away from said impression cylinder, and means for adjusting said ink fountain toward and away from said form cylinder, said fountain adjusting means being operable independently of said form cylinder adjusting means.

22. In combination, an impression cylinder, a form cylinder, inking mechanism comprising an ink fountain and a fountain roller revoluble therein to deliver ink to said form cylinder, means for adjusting the form cylinder and inking mechanism as a unit toward and away from said impression cylinder, and means for adjusting said fountain roller toward and away from said form cylinder, said fountain roller adjusting

means being operable independently of said form cylinder adjusting means.

23. In combination, an impression cylinder, a form cylinder, inking mechanism comprising an ink fountain and a fountain roller revolvable therein to deliver ink to said form cylinder, means for adjusting the form cylinder and inking mechanism as a unit toward and away from said impression cylinder, and means for adjusting said ink fountain toward and away from said form cylinder, said fountain adjusting means being operable either simultaneously with or independently of said form cylinder adjusting means.

24. In combination, an impression cylinder, a form cylinder, inking mechanism comprising an ink fountain and a fountain roller revolvable therein to deliver ink to said form cylinder, means for adjusting the form cylinder and inking mechanism as a unit toward and away from said impression cylinder, and means for adjusting said fountain roller toward and away from said form cylinder, said fountain roller adjusting means being operable either simultaneously with or independently of said form cylinder adjusting means.

25. In combination, an impression cylinder, a form cylinder, inking mechanism comprising an ink fountain and a fountain roller revolvable therein to deliver ink to said form cylinder, and means for adjusting the form cylinder and inking mechanism as a unit toward and away from said impression cylinder, said adjusting means including mechanism for further adjusting said form cylinder and inking mechanism at each end independently toward and away from said impression cylinder.

26. In combination, an impression cylinder, a form cylinder, inking mechanism comprising an ink fountain and a fountain roller revolvable therein to deliver ink to said form cylinder, means

for adjusting the form cylinder and inking mechanism as a unit toward and away from said impression cylinder, said adjusting means including mechanism for further adjusting said form cylinder and inking mechanism at each end independently toward and away from said impression cylinder, and means for maintaining the peripheral relationship between said fountain roller and form cylinder during said adjustment.

27. In combination, an impression cylinder, superimposed carriages movable along parallel planes toward and away from said cylinder, a form cylinder journaled for rotation upon one of said carriages and normally coacting with said impression cylinder, an ink transfer roller journaled for rotation upon the other of said carriages and normally coacting with said form cylinder, means for simultaneously moving said carriages relative to said impression cylinder and relative to each other to separate said cylinders from each other and said form cylinder from said roller, and means for independently moving said carriages relative to said impression cylinder and relative to each other.

28. In combination, an impression cylinder, lower and upper carriages movable along parallel planes toward and away from said cylinder, a form cylinder rotatably journaled upon said lower carriage and normally coacting with said impression cylinder, an ink roller mounted upon said upper carriage and normally coacting with said form cylinder, and means for either independently or simultaneously moving said carriages relative to said impression cylinder and relative to each other to separate said cylinders from each other and said form cylinder from said roller.

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